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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,119	11/21/2003	Lawrence A. Clevenger	FIS920030219US1	1118
32074	7590	06/22/2005	EXAMINER	
INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			DANG, PHUC T	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 06/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/707,119

Applicant(s)

CLEVENGER ET AL.

Examiner

PHUC T. DANG

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on election filed on April 11, 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 12-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3, 5 and 9 is/are rejected.
- 7) ☒ Claim(s) 2, 4, 6-8, 10 and 11 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 112103
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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## **DETAILED ACTION**

### **Restriction/election**

1. Applicant's election without traverse of Group I (claims 1-11) filed on April 11, 2005, drawn to a method of forming a layer of interconnect in an integrated circuit and withdrawn Group II (claims 12-22).

Applicants have the right to file a divisional application covering the subject matter of the non-elected claims.

### **Information Disclosure Statement**

2. The office acknowledges receipt of the following items from the applicant:

Information Disclosure Statement (IDS) filed on November 21, 2003.

### **Specification**

3. The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### **Claim Objections**

4. Claim 1 is objected to because of the following reason:

In claim 1, insert "(ILD)" after – a first layer of interlayer dielectric --.

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al., hereinafter "Nakagawa" (U.S. Patent No. 6,562,710 B2 in view of Kimock et al., hereinafter "Kimock" (U.S. Patent No. 5,135,808).

Regarding claim 1, Nakagawa discloses a method for fabricating a semiconductor device comprising the steps of:

depositing a first layer of interlayer dielectric (ILD) (111, Fig. 2C) on a lower layer of the integrated circuit above a set of lower alignment marks (109a, Fig. 2C);

depositing a first hardmask layer (112, Fig. 2C) on the first layer of ILD (111, Fig. 2C);

forming an upper set of alignment marks (114a, Fig. 3C);

patterning the ILD (111, Fig. 3A) through the hardmask layer (112, Fig. 3A) to form a set of apertures (111a, Fig. 3A) in the ILD (111, Fig. 3A); and

forming a conductive interconnect (11e, Fig. 3B) in the set of apertures (111a, Fig. 3B).

Nakagawa discloses all the features of the claimed invention as discussed above, but does not disclose the first hardmask comprises of TaN on the first layer of ILD and the first layer being substantially transparent in a relevant wavelength range.

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Kimock, however, discloses the first hardmask comprises of TaN on the first layer of ILD and the first layer being substantially transparent in a relevant wavelength range [col. 11, line 64-col. 12, line 11].

It would have been obvious to one having ordinary skilled in the art at the time the invention was made to modify the above discussed teaching of Nakagawa as taught by Kimock for a purpose of improving a process of fabricating a semiconductor device.

6. Claims 3, 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa and Kimock in view of Kasahara (U.S. Patent No. 6,358,766 B1).

Regarding claims 3, 5 and 9, Nakagawa discloses all the features of the claimed invention as discussed above, but does not disclose the hardmask layer has a thickness ranging from 5 nm to 100 nm and the hardmask is deposited by chemical vapor deposition by reacting a precursor containing Ta in an ambient containing N<sub>2</sub> and substantially transparent in the relevant wavelength range.

Kasahara, however, discloses the hardmask layer has a thickness ranging from 5 nm to 100 nm and the hardmask is deposited by chemical vapor deposition by reacting a precursor containing Ta in an ambient containing N<sub>2</sub> and substantially transparent in the relevant wavelength range [col. 12, lines 61-63 and col. 19, line 19-col. 20, line 11].

It would have been obvious to one having ordinary skilled in the art at the time the invention was made to modify the above discussed teaching of Nakagawa as taught by Kasahara for a purpose of improving a process of fabricating a semiconductor device.

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### **Allowable Subject Matter**

7. The following is a statement of reason for the indication of allowable subject matter:

Claims 2, 4, 6-8 and 10-11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

None of the prior art made of record does not disclose the hardmask layer is deposited by sputter deposition of Ta in an ambient containing N<sub>2</sub> and a carrier gas such that  $(N_2 \text{ flow})/(N_2 + \text{carrier flow}) > 0.5$  as cited in claim 2 and the hardmask layer has a resistivity greater than about 400 Ohms-cm as cited in claim 4 and the hardmask layer has a composition of less than 50% Ta as cited in claim 11.

Claims 4, 6, 8 and 10 are depend on claim 2, then, they also would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

### **Conclusion**

7. Applicants are advised to cancel the non-elected claims of Group II (claims 11-22) in response upon to the next Office action if the application is considered to be allowed.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Sugiyama'614 and Komuro'328 are cited interest.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuc T. Dang whose telephone number is (571) 272-1776. The examiner can normally be reached on 8:00 am-5:00 pm.

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10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David C. Nelms can be reached on (571) 272-1787. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and After Final communications.

11. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Phuc T. Dang

PD

A handwritten signature in black ink, appearing to read 'Phuc T. Dang', with a long, sweeping horizontal line extending to the right.

Primary Examiner

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